the sediment and the size and velocity of the stream transporting it. Owing to the fact that observations as to the amounts of the fine clay-like detritus of glacial streams are more numerous and reliable than those upon the coarser material, the bulk of the contemporaneous clays was taken as a basis of calculation, rather than the sand-plain itself. In estimating the load of the glacial stream, I have taken the maximum value of 13 grams per liter, given by Reid for the Muir Glacier (the highest value on record), as the one which, in all probability, would most nearly correspond to the load of a glacial stream during the closing stages of the continental ice sheet.

At the time of the formation of the Barrington clays the land stood at a level of at least forty feet below that at present existing, and the deposition took place in an inclosed bay, having the ice sheet as its northern boundary, a ridge of till and modified drift for its eastern boundary, and an earlier sand-plain as its southern boundary. On the west was a broad and deep opening, connecting with Narragansett Bay, and admitting of a complete commingling of the salt and fresh waters. Into this inclosed bay flowed a stream with a width, as indicated by its esker, of 150 feet, a depth of some 20 feet, and an average velocity of not over 5 feet per second. On the assumption that the amount of sediment was 13 grams per liter, the daily discharge of clayey material would have been some 526,500 tons per day.

Experiments recently conducted by Professor W. O. Crosby in connection with professional work for the Metropolitan Water Board of Massachusetts, the results of which he has kindly placed at my disposal, indicate that material such as the clay beds are essentially composed of, *i.e.*, quartz-flour, settles with great rapidity, and it can be shown that practically the entire amount of sediment brought in by the glacial stream must have been deposited within the inclosed bay described.

The clays cover about a square mile in area, have a maximum thickness of 60 feet, and a total bulk of 95,300,000 tons. Dividing this bulk by the daily discharge of sediment by the glacial stream (526,500 tons), the time of deposition of the clays is indicated to have been 181 *days*, or almost exactly six months.

The Barrington deposits probably represent very nearly average conditions; hence a period of six months seems a fair estimate of time for the formation of a simple sand-plain of moderate size. In the case of large plains, with areas of several or many square miles, the period of deposition may be considered as extending over more than one season of melting, there being in the meantime either no retreat of the ice margin or a retreat so slight that the intervening space was completely filled and the sand-plains united into a single compound plain.

Myron L. Fuller.

---

*PROPOSED SURVEY OF THE NILE.**

The Egyptian government has agreed to undertake a survey of the Nile with the object of determining the species of fishes inhabiting its waters. It is due in the first instance to the efforts and energetic action of Dr. John Anderson, F.R.S., who has already done so much to enlarge our knowledge of the fauna of Egypt that this important project, to which so much scientific interest is attached, has now taken definite shape. A memorandum prepared by him, setting forth his proposals for the survey and the lines of his scheme for carrying it out, received the approval of Lord Lister, President of the Royal Society; Professor E. Ray Lankester, Director of the Natural History Departments of the British Museum; Dr. A. Günther, President of the Linnæan Society, and Mr. P. L. Sclater, Secretary of the

*From the London *Times*.

Zoological Society, and was then forwarded by him to Lord Cromer, to be submitted to the Egyptian government, with a strong recommendation for its favorable consideration from these eminent scientific men. The Trustees of the British Museum furthermore gave the scheme their powerful and influential support, and intimated their willingness to assist in a practical manner by undertaking to supply the necessary collecting-boxes, with alcohol to fill them. An essential feature of the scheme is that the fishes collected are to be sent to London to be studied and determined by Mr. Boulenger, the ichthyologist on the staff of the Museum, and the Trustees have, it is understood, agreed to give him every facility for doing this, thus practically placing the services of their officer at the disposal of the Egyptian government for the purpose for the three years which it is estimated will be required to accomplish the survey.

Our knowledge of the fishes of the Nile appears to be very imperfect. It may be said to have taken its origin in 1750, when Hasselquist described thirteen species found in the Deltaic area or in its immediate proximity. In 1847 sixty probably represented the number of known species. In 1861–63 Petherick made, at Dr. Günther's request, a collection of fishes from the Nile for the British Museum. The specimens were obtained at Cairo, Khartum and Gondokoro, and were described by Dr. Günther in an appendix to Petherick's 'Travels,' published in 1889. The collection contained eighteen new additions to the fauna, and raised the number of known species to eighty-two. Since 1869 the fishes of the Nile have been almost completely neglected. At present about ninety species are known to inhabit the river, but this number, considering the vast extent of its waterway and the very diverse physical conditions which characterize many parts of its course, cannot be considered as at all approaching finality.

The collections hitherto made from the Nile have principally been obtained from below the First Cataract; indeed, Rüppell and Petherick are the only two collectors who had opportunities to investigate the river above Assuan. The former distinguished traveler and naturalist largely collected in lower Egypt, and not a few of Petherick's specimens were from the same region. In Dr. Günther's account of this collection only six species were distinctly recorded as coming from Gondokoro, Khartum and the White Nile, while thirteen, besides the foregoing six, species were stated to belong properly to the reach of the Nile above the Sixth Cataract. Here it may be observed that, while we possess a fragmentary knowledge of the species from Khartum southwards, the immense tract of the Nile from the First to the Sixth Cataract remains practically untouched.

Morever, as within the next few years a change will be effected in the distribution of the Nile waters by the construction of the controlling powers now in course of erection at Philæ and Assiut, and as other similar structures or dams are likely to follow towards the south, all of which are certain ultimately to limit more or less the range of certain species of fishes, it is much to be desired that, before any of these triumphs of the Department of Irrigation have been completed, we should be placed in possession of the main features and present condition of the piscine flora of the great reaches of the river.

The present time is also extremely opportune for the commencement of the proposed investigation, since the authorities of the Congo Free State have satisfactorily inaugurated a survey of the Congo. Mr. G. A. Boulenger has been entrusted, with the sanction of the Trustees of the British Museum, with the description of the fishes of the Congo for the Congo Free State, and, as his services will be at the disposal of the

Egyptian government for the Nile exploration, the two surveys should mutually benefit each other. The materials afforded by the one cannot but throw light upon those of the other, many of the species of the two great rivers being closely allied.

As regards the scope and working of the survey, it is suggested, as a preliminary step, that a series of stations should be established along the river, extending, at intervals, from the Delta to Lado, in the territory leased by the Egyptian government to the Congo Free State, and as far to the south of this as possible. Instructions for collecting fishes, written in English and Arabic, will be sent to some responsible official in each of these localities, accompanied by a collecting box and alcohol, supplied by the British Museum, while the services of fishermen and others will be enlisted in the work, a fair price being paid to them for the fishes they collect.

Dr. Keatinge, the officer in charge of the Museum of Natural History of the Medical School of Cairo, has been entrusted with the general supervision of the service of the survey. He will see to the reception of the collecting materials from the British Museum, to their distribution to the different stations, to their reception when returned filled with fishes, and to forwarding them to London. The actual superintendence of the working of the survey is to be undertaken by an officer, who will be constantly on the river at all seasons, visiting the different stations, inspecting the collections formed, making sure that everything possible is being done to obtain fishes, and generally satisfying himself that the specimens are properly preserved, and that they are fairly representative. He will also particularly note the physical characters of the river at each station, find out as much as possible about the habits of the fishes, the depth at which they are found, the general character of the river bed, the seasons in which the fishes breed, and the nature of their food. He will further be required to satisfy himself that the native names have been correctly recorded in Arabic and rightly applied.

Mr. Leonard Loat has been appointed to this responsible post of superintendent of the survey, and on him will devolve the task of seeing that the work is carried out in a thoroughly efficient manner. He left London a short time ago for Cairo, and has already commenced operations on Lake Menzaleh. During the first year it is proposed to carry the investigation as far as Wady Halfa; in the second year the river will be worked between Wady Halfa and Berber, and in the third year it is hoped to continue the survey to Sobat, and, if conditions are favorable, through the *sudd* and rapids between Lado and Dufile, and, ultimately, perhaps to carry the exploration of the river to its origin in the Albert Nyanza. In this connection it may be stated that the assistance of the authorities of the Congo Free State has been invited, and an assurance of their hearty coöperation has, it is understood, been received informally, leaving no room for doubt that an official expression to the same effect will be shortly forthcoming.

These are the lines on which the projected survey of the Nile is to be conducted. It is obvious that, apart from the mere knowledge of how many species of fishes exist in the river, great economic questions will come to the front when their life-history is studied. Also it is hoped that the survey may help to elucidate many problems relating to the fishes sculptured on the ancient monuments of Egypt. Dr. Anderson is taking special pains to obtain drawings of as many of these fish forms as possible, and he regards it as not improbable that a scientific investigation of the fishes obtained in the river will lead to an identification of many of the species represented in stone. These

questions, however, can never be usefully determined until there exists on record a basis on which to work, in the form of a detailed description on each species accompanied, as far as practicable, by a figure. The scheme, therefore, includes provision for the publication of the scientific results in a book uniform with the sumptuous volume which Dr. Anderson has recently issued on the 'Reptiles and Batrachians of Egypt.' This work forms the first volume of the 'Zoology of Egypt.' He is at present engaged in working out the collections of mammals on which the second volume will be based. The 'Fishes of the Nile' will form the third volume of this monumental record of the fauna of the country.

SCIENTIFIC BOOKS.

Birds. By A. H. EVANS, M.A., Clare College, Cambridge. London, Macmillan & Co., Limited; New York, The Macmillan Company. 1899. 8vo. 144 text cuts. Pp. xvi + 635. Price, $3.50.

Mr. Evans's 'Birds' forms Vol. IX. of the 'Cambridge Natural History,' and is intended as a popular systematic review of the class Aves. In a volume of 650 pages it is, of course, impossible to treat in much detail any of the one hundred and thirty odd families of birds, or to particularize respecting many of the 12,000 to 13,000 or more species now recognized by systematists. It would seem, however, that a little more space might have been profitably given to the generalities of the subject, as structure, classification, geographical distribution, migration, etc., all of which is compressed into the short space of twenty-two pages, of which three are devoted to the terminology of the external parts of a bird. The remarks on classification and geographical distribution are mainly historical. Mr. Evans adopts, with 'some slight modifications,' Dr. Gadow's scheme of classification and Sclater's scheme of geographical areas. In referring to the wide differences of opinion among authorities on the subject of genera and species he says: "It cannot be denied that genera and species are merely 'convenient bundles,' and that divisions of either, if carried too far, defeat the object for which classification is intended. Genera are only more distinct from species, and species from races, because the intervening links have disappeared; and if we could have before us the complete series which, according to the doctrine of evolution, has at some time existed neither genus nor species would be capable of definition any more than races in many cases; while the same remark will apply to the larger groups." While such statements are not new they have not been presented in popular works, the lay reader being allowed to retain the old idea of the tangible nature of generic and specific groups. The tendency among certain systematists to recognize subspecies on the basis of the slightest recognizable differences leads naturally to the multiplication of genera, and the increase of subfamilies, etc., to conform, so to speak, to the new unit of measurement consequent upon the recognition, in nomenclature, of the grade of differentiation that is considered as a sufficient basis for 'races' or subspecies. It is to this, doubtless, that Mr. Evans alludes as being likely to 'defeat the object for which classification was intended.'

Beginning with *Archæopteryx*, and ending with the Finches, the various groups of birds are passed briefly in review. The characters of the ordinal, subordinal and family groups are succinctly stated, and some little account is given of the number, distribution and habits of the species, the latter usually in general terms. Very little is said about any particular species, though sometimes a characteristic member of a group is taken as the subject of more definite remark, or in cases where the number of species is so few that something may be said of each. The reader may be thus often disappointed, in seeking information regarding particular species, to find little, if any, reference to the object of his search. In a work of the dimensions of the present volume this must be inevitable, yet it will prove a convenient source of information on the general subject of bird life throughout the world. References to more detailed accounts of species or groups of particular interest are, however, often supplied in foot notes. Only about one-sixth of the work is de-